

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 23

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte LARRY HILLYER and MAX F. HINEMAN

Appeal No. 2002-1415
Application No. 09/141,812

HEARD: February 20, 2003

Before HAIRSTON, RUGGIERO, and BLANKENSHIP, Administrative Patent Judges.

BLANKENSHIP, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 1, 2, 4-12, 14, and 16-28.

We reverse.

BACKGROUND

The invention is directed to a method of removing residues after etching a via during fabrication of integrated circuits. Claim 8 is reproduced below.

8. A method of removing etch residue from a via after etching the via through an insulating layer in a partially fabricated integrated circuit assembly, the method comprising exposing the etch residue to a plasma formed from ammonia and oxygen.

The examiner relies on the following references:

Chen et al. (Chen)	5,661,083	Aug. 26, 1997
Savas et al. (Savas)	5,811,022	Sep. 22, 1998 (filed Nov. 15, 1994)
Molloy et al. (Molloy)	5,849,639	Dec. 15, 1998 (filed Nov. 26, 1997)
Honda	5,977,041	Nov. 2, 1999 (filed Sep. 23, 1997)

Claims 1, 2, 4, 6, 8-12, 14, and 19 stand rejected under 35 U.S.C. § 103 as being unpatentable over Molloy and Savas.

Claims 5 and 7 stand rejected under 35 U.S.C. § 103 as being unpatentable over Molloy, Savas, and Honda.

Claims 16-18 stand rejected under 35 U.S.C. § 103 as being unpatentable over Molloy and Chen.

Claims 20-28 were rejected under 35 U.S.C. § 103 over various combinations of prior art in the Final Rejection. However, those rejections are not contested in this appeal.

Claims 3, 13, and 15 have been canceled.

We refer to the Final Rejection (Paper No. 10) and the Examiner's Answer (Paper No. 16) for a statement of the examiner's position and to the Brief (Paper No. 15) and the Reply Brief (Paper No. 17) for appellants' position with respect to the claims which stand rejected.

OPINION

At the outset, we note that appellants do not contest the rejections of claims 20 through 28, effectively withdrawing the appeal as to those claims. "Claims 20-28 will not be the subject of this appeal brief." (Brief at 2.) Accordingly, the appeal as to claims 20 through 28 is dismissed.

Claims 1, 2, 4, 6, 8-12, 14, and 19, containing all the remaining independent claims, have been rejected under 35 U.S.C. § 103 over the combined teachings of Molloy and Savas. The rejection (Answer at 3-4) relies on Molloy as disclosing a process for forming a via in an insulating layer so as to uncover a metal layer. Molloy teaches that both a photoresist layer (col. 1, ll. 49-62) and photoresist residues that may remain at via holes (col. 2, ll. 15-30) must be removed when etching vias in integrated circuit devices. The rejection refers to column 4, lines 28 through 50 of Molloy as teaching bombarding a wafer surface with a mixture of gases that may include oxygen, but the reference is deemed to not disclose the mixing of ammonia with

oxygen plasma.¹ The examiner turns to Savas at columns 19 and 20, in particular column 20, lines 14-37, for teaching “a process to remove the resist and residue via an oxygen plasma wherein ammonia as well as other compounds may be mixed with the oxygen plasma....”

Appellants argue that there is no motivation to select ammonia from the possible additives listed by Savas. The examiner’s position is that motivation exists because Savas specifically states that mixing ammonia with oxygen will increase the removal rate of the resist. (Answer at 6.) The examiner further contends that Savas teaches a cleaning step “directed to clean a via and strip the photoresist as in Molloy” (*id.* at 7) and that the teachings of Savas “show that mixture of ammonia and oxygen to clean [a] via and strip a photoresist is [sic; was] known in the art” (*id.* at 8).

Savas teaches:

[O]ther gases may be used to enhance stripping. In particular, as is known in the art, gases may be added to oxygen in small concentrations to attack specific chemical residues that may form on the resist. During etching, the resist may become very hard and dense. Ion implantation may occur and impurities such as boron or arsenic may become embedded in the resist. Etch processes may also produce a SiO₂ residue or implant aluminum contaminants in the resist. As is known in the art, these and other side effects from wafer processing can create a resist or film that is very resistant to reaction with oxygen atoms alone. Additives

¹ Molloy indicates oxygen and “amine gases” as possible mixtures (col. 4, ll. 27-31). An amine is “one of a class of organic compounds which can be considered to be derived from ammonia by replacement of one or more hydrogens by functional groups.” McGraw-Hill Dictionary of Scientific and Technical Terms Fifth Ed. at 78 (1994). An amine gas thus may be, but is not necessarily, derived from ammonia. See, e.g., Kirk-Othmer Encyclopedia of Chemical Technology Third Ed., Vol. 2 at 276-77, John Wiley & Sons (1978) (providing examples of manufacturing amine: four examples using ammonia and one using hydrogen cyanide and an olefin).

that make soluble or volatile compounds with a given chemical residue or contaminant may be added to enhance the removal of the resist. Any one of a variety of additives may be selected depending upon the composition of the resist and the etch process used. Common additives include Ar, He, SF₆, Cl₂, CHF₃, C₂F₆, CFC's, N₂, N₂O, NH₃ [ammonia], H₂, water vapor, or the like. For instance, after a polysilicon etch process, using a normal resist, CF₄ is preferably added to the O₂ gas in concentrations of 0.2% to 10% in order to enhance resist removal.

Savas at col. 20, ll. 14-34.

We disagree with appellants' arguments to the extent they may be based on the view that the number of possible additives for combining with oxygen tends to show nonobviousness of the specific combination of ammonia and oxygen. See, e.g., Merck & Co. v. Biocraft Labs., Inc., 874 F.2d 804, 806-07, 10 USPQ2d 1843, 1845-46 (Fed. Cir. 1989) (claimed combination of two drugs held to have been obvious in view of reference which disclosed 1200 possible combinations, without highlighting preference of two that were claimed). Disclosure of "a multitude of effective combinations does not render any particular formulation less obvious." Id. at 807, 10 USPQ2d at 1846.

However, we agree with appellants that Savas does not teach that the combination of oxygen and ammonia is effective for the uses claimed by appellants. Nonetheless, we disagree that "[e]ach of Appellants' claims specifically recite simultaneous use of ammonia and oxygen after etching a via through an insulating layer to expose metal." (Brief at 4.)

Instant claim 8, and those depending therefrom, say nothing of exposing "metal." However, each of the independent claims requires treatment of a via with a plasma (or vapor; claim 1) containing ammonia and oxygen. Notwithstanding the examiner's

indication that Savas teaches a step “directed to clean a via,” we find no specific teaching in Savas that any of the above-noted additives for mixing with oxygen are suitable for treatment of a via following an etch. In our view, Savas provides evidence that the artisan was familiar with use of the listed additives and with the particular applications to which they were suited; i.e., the additives “may be selected depending upon the composition of the resist and the etch process used.”

While we consider this to be a close case, we believe that the evidence relied upon falls short of establishing prima facie obviousness of the claimed invention. In light of the teachings of Molloy and Savas, it appears that no more than an “obvious to try” standard has been met. See, e.g., In re Gieger, 815 F.2d 686, 688, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987) (“At best, in view of these disclosures, one skilled in the art might find it obvious to try various combinations of these known scale and corrosion prevention agents. However, this is not the standard of 35 U.S.C. § 103.”).

We thus conclude that the rejection fails to meet the required evidentiary standard (i.e., by a preponderance) in establishing facts necessary for the conclusion of obviousness.

Further, neither Honda nor Chen, applied in combinations against dependent claims, remedies the deficiencies of Molloy and Savas as applied against the independent claims. We thus do not sustain the section 103 rejection of any of claims 1, 2, 4-12, 14, and 16-19.

Appeal No. 2002-1415
Application No. 09/141,812

CONCLUSION

The rejection of claims 1, 2, 4-12, 14, and 16-19 under 35 U.S.C. § 103 is reversed. The appeal as to claims 20-28 stands dismissed.

REVERSED

KENNETH W. HAIRSTON
Administrative Patent Judge

JOSEPH F. RUGGIERO
Administrative Patent Judge

HOWARD B. BLANKENSHIP
Administrative Patent Judge

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